SEQUENCE LISTING

<110> MOECKEL, Bettina
       BATHE, Brigitte
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<120> Nucleotide sequences coding for the rpoB gene

<130> 219774US0XCIP

<140> new application
<141> 2002-02-19

<150> DE 10107229.5
<151> 2001-02-16

<150> US 09/887052
<151> 2001-06-25

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<170> PatentIn version 3.1

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cttaatggcc ttgaccagcc aggtgcaatt acccgcgtga g gtg ctg gaa gga ccc          716
                                              Val Leu Glu Gly Pro
                                                1                 5


atc ttg gca gtc tcc cgc cag acc aag tca gtc gtc gat att ccc ggt          764
Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val Val Asp Ile Pro Gly
            10                  15                  20

gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg          812
Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val
                25                  30                  35

ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt          860
Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly
            40                  45                  50

acg cct gag tgg cgt gct cgt cag aag gaa gaa ttc ggc gag gga gcc          908
Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu Phe Gly Glu Gly Ala
            55                  60                  65

cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc          956
Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Glu Leu Ser Pro Ile
70                  75                  80                  85

cag gat tac tct gga aac atg tcc ctg agc ctt tcg gag cca cgc ttc          1004
Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu Ser Glu Pro Arg Phe
                90                  95                  100

gaa gac gtc aag aac acc att gac gag gcg aaa gaa aag gac atc aac          1052
Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys Glu Lys Asp Ile Asn
                105                 110                 115

tac gcg gcg cca ctg tat gtg acc gcg gag ttc gtc aac aac acc acc          1100
Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe Val Asn Asn Thr Thr
                120                 125                 130

ggt gaa atc aag tct cag act gtc ttc atc ggc gat ttc cca atg atg          1148
Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly Asp Phe Pro Met Met
        135                 140                 145

acg gac aag gga acg ttc atc atc aac gga acc gaa cgc gtt gtg gtc          1196
Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr Glu Arg Val Val Val
150                 155                 160                 165

agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat          1244
Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp
                170                 175                 180

aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct tcc cgt          1292
Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Ser Arg
                185                 190                 195

ggt gct tgg ctt gag ttt gac gtc gat aag cgc gat tcg gtt ggt gtt          1340
Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg Asp Ser Val Gly Val
        200                 205                 210
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2

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cgt att gac cgc aag cgt cgc cag cca gtc acc gta ctg ctg aag gct      1388
Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr Val Leu Leu Lys Ala
    215             220             225

ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa      1436
Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Gly Phe Ser Glu
230             235             240                 245

atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag      1484
Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu
            250             255             260

gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc      1532
Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Glu Gln Pro Thr
            265             270             275

cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag      1580
Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys
        280             285             290

cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc      1628
Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu
        295             300             305

ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac      1676
Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp
310             315             320                 325

atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc      1724
Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg
                330             335             340

gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac      1772
Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro Val Glu Thr Asp Asp
            345             350             355

atc gac cac ttt ggt aac cgt cgt ctg cgt acc gtt ggc gaa ctg atc      1820
Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile
        360             365             370

cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt      1868
Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg
    375             380             385

gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg      1916
Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu
390             395             400                 405

atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act      1964
Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr
            410             415             420

tcc cag ctg tct cag ttc atg gac cag aac aac tcc ctg tct ggt ttg      2012
Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn Ser Leu Ser Gly Leu
            425             430             435
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3

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act cac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt       2060
Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg
        440                 445                 450

gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc       2108
Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly
        455                 460                 465

cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc       2156
Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile
470                 475                 480                 485

ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag       2204
Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu
                490                 495                 500

acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac       2252
Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp
            505                 510                 515

tac ctt acc gct gat gag gaa gac cgc ttc gtt gtt gcg cag gca aac       2300
Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn
        520                 525                 530

acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt       2348
Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp Glu Thr Val Thr Val
        535                 540                 545

cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gcg gtt gat       2396
Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp
550                 555                 560                 565

tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gcg atg       2444
Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met
                570                 575                 580

att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gcg       2492
Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala
                585                 590                 595

aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc       2540
Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe
        600                 605                 610

gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg       2588
Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu
        615                 620                 625

gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc       2636
Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe
630                 635                 640                 645

atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt       2684
Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg
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aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg       2732
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4

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        Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly
                    680                 685             690

        cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt        2828
        Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val
                    695                 700             705

        gcg ttc atg cct tgg gaa ggc cac aac tac gag gat gcg atc atc ctc        2876
        Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu
        710                 715             720                 725

        aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag        2924
        Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu
                        730             735                 740

        gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc        2972
        Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile
                    745                 750             .755

        acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac        3020
        Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp
                    760                 765             770

        gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc        3068
        Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile
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        ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa        3116
        Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu
        790                 795             800                 805

        gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc        3164
        Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg
                        810             815                 820

        gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc        3212
        Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly
                    825                 830             835

        gtg cgt cac ttc tcc cgc gag gac gac gac gat ctg gct cct ggc gtc        3260
        Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val
                    840                 845             850

        aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac        3308
        Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp
        855                 860             865

        ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa        3356
        Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys
        870                 875             880                 885

        att ttg cct cag gaa gat atg cca ttc ctt cca gac ggc act cct gtt        3404
        Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val
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5

gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt   3452
Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly
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cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc   3500
Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser
            920   925   930

gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct   3548
Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro
            935   940   945

gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg   3596
Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val
950   955   960   965

ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca   3644
Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser
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cgt cca aac cgc gac ggc gac gtc atg gtt aac gcg gat ggt aaa gca   3692
Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala
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acg ctt atc gac ggt cgc tcc ggt gag cct tac ccg tac ccg gtt   3737
Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr Pro Tyr Pro Val
            1000   1005   1010

tcc atc ggc tac atg tac atg ctg aag ctg cac cac ctc gtt gac   3782
Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His His Leu Val Asp
            1015   1020   1025

gag aag atc cac gca cgt tcc act ggt cct tac tcc atg att acc   3827
Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr Ser Met Ile Thr
            1030   1035   1040

cag cag cca ctg ggt ggt aaa gca cag ttc ggt gga cag cgt ttc   3872
Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly Gly Gln Arg Phe
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ggc gaa atg gag gtg tgg gca atg cag gca tac ggc gct gcc tac   3917
Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr Gly Ala Ala Tyr
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aca ctt cag gag ctg ctg acc atc aag tct gat gac gtg gtt ggc   3962
Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp Asp Val Val Gly
            1075   1080   1085

cgt gtc aag gtc tac gaa gca att gtg aag ggc gag aac atc ccg   4007
Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly Glu Asn Ile Pro
            1090   1095   1100

gat cca ggt att cct gag tcc ttc aag gtt ctc ctc aag gag ctc   4052
Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu Leu Lys Glu Leu
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cag tcc ttg  tgc ctg aac gtg gag  gtt ctc tcc gca gac  ggc act       4097
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        1120                1125                1130

cca atg gag  ctc gcg ggt gac gac  gac gac ttc gat cag  gca ggc       4142
Pro Met Glu  Leu Ala Gly Asp Asp  Asp Asp Phe Asp Gln  Ala Gly
        1135                1140                1145

gcc tca ctt  ggc atc aac ctg tcc  cgt gac gag cgt tcc  gac gcc       4187
Ala Ser Leu  Gly Ile Asn Leu Ser  Arg Asp Glu Arg Ser  Asp Ala
        1150                1155                1160

gac acc gca  tagcagatca gaaaacaacc gctagaaatc aagccataca            4236
Asp Thr Ala
        1165

tcccccggac attgaagaga tgttctgggg ggaaagggag ttttacgtgc tcgacgtaaa   4296

cgtcttcgat gagctccgca tcggcctggc caccgccgac gacatccgcc gttggtccaa   4356

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caagcgtgtc cgctacaagg gcatcatctg tgaacgctgt ggcgttgagg tcaccaagtc   4536

caaggtgcgc cgtgagcgca tgggacacat tgagctcgct gcaccagtaa cccacatttg   4596

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cttcatcaag cttgctccaa agcagatgat ccgcgatgag aagctctacg atgaactgat   5016

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7

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Ala Pro Ile Glu Val Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr
            35                  40                  45

Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu
    50                  55                  60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu
65                  70                  75                  80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu
                85                  90                  95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys
            100                 105                 110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe
            115                 120                 125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly
    130                 135                 140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr
145                 150                 155                 160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe
                165                 170                 175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys
            180                 185                 190

Val Ile Pro Ser Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg
            195                 200                 205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Gln Pro Val Thr
    210                 215                 220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg
225                 230                 235                 240
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8

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Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val
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Ala Asn Thr Asp Glu Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro
              260             265             270

Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser
              275             280             285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys
    290             295             300

Ile Asn Arg Lys Leu Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr
305             310             315             320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu
              325             330             335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro
              340             345             350

Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr
              355             360             365

Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met
    370             375             380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile
385             390             395             400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg
              405             410             415

Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn
              420             425             430

Ser Leu Ser Gly Leu Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro
              435             440             445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His
    450             455             460
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9

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Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro
465             470             475             480


Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro
                485             490             495


Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu
            500             505             510


Thr Asp Gln Ile Asp Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val
        515             520             525


Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp
    530             535             540


Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly
545             550             555             560


Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser
            565             570             575


Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg
            580             585             590


Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg
        595             600             605


Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr
    610             615             620


Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn
625             630             635             640


Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu
            645             650             655


Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr
        660             665             670


Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln
        675             680             685


Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly
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10

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu
705   710   715   720

Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr
                725   730   735

Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu
            740   745   750

Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val
        755   760   765

Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val
    770   775   780

Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr
785   790   795   800

Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys
                805   810   815

Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr
            820   825   830

Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp
        835   840   845

Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys
    850   855   860

Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys
865   870   875   880

Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro
            885   890   895

Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg
            900   905   910

Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala
        915   920   925

11

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Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu
    930              935               940

Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu
945              950               955               960

Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly
             965               970               975

Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn
             980               985               990

Ala Asp Gly Lys Ala Thr Leu Ile  Asp Gly Arg Ser Gly  Glu Pro Tyr
         995               1000              1005

Pro Tyr  Pro Val Ser Ile Gly  Tyr Met Tyr Met Leu  Lys Leu His
    1010              1015               1020

His Leu  Val Asp Glu Lys Ile  His Ala Arg Ser Thr  Gly Pro Tyr
    1025              1030               1035

Ser Met  Ile Thr Gln Gln Pro  Leu Gly Gly Lys Ala  Gln Phe Gly
    1040              1045               1050

Gly Gln  Arg Phe Gly Glu Met  Glu Val Trp Ala Met  Gln Ala Tyr
    1055              1060               1065

Gly Ala  Ala Tyr Thr Leu Gln  Glu Leu Leu Thr Ile  Lys Ser Asp
    1070              1075               1080

Asp Val  Val Gly Arg Val Lys  Val Tyr Glu Ala Ile  Val Lys Gly
    1085              1090               1095

Glu Asn  Ile Pro Asp Pro Gly  Ile Pro Glu Ser Phe  Lys Val Leu
    1100              1105               1110

Leu Lys  Glu Leu Gln Ser Leu  Cys Leu Asn Val Glu  Val Leu Ser
    1115              1120               1125

Ala Asp  Gly Thr Pro Met Glu  Leu Ala Gly Asp Asp  Asp Asp Phe
    1130              1135               1140
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Asp Gln  Ala Gly Ala Ser Leu  Gly Ile Asn Leu Ser  Arg Asp Glu
    1145                 1150                 1155


Arg Ser  Asp Ala Asp Thr Ala
    1160                 1165



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<223>  Substitution of adenine by thymine


<220>
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<222>  (1288)..(1288)
<223>  Substitution of cytosine by thymine


<220>
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<222>  (715)..(715)
<223>  Substitution of cytosine by thymine


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acaatgtgac tcgtgatttt tgggtggatc agcgtaccgg tttggttgtc gatctagctg       60

aaaatattga tgatttttac ggcgaccgca gcggccagaa gtacgaacag aaattgcttt      120

tcgacgcctc cctcgacgat gcagctgtct ctaagctggt tgcacaggcc gaaagcatcc      180

ctgatggaga tgtgagcaaa atcgcaaata ccgtaggtat tgtgatcggt gcggtattgg      240

ctctcgtggg cctggccggg tgttttgggg cgtttgggaa gaaacgtcga gaagcttaac      300

ctgctgttca aatagatttt ccctgtttcg aattgcggaa accccgggtt tgtttgctag      360

ggtgcctcgt agaaggggtc aagaagattt ctgggaaacg cgcccgtgcg gttggttgct      420

aatagcacgc ggagcaccag atgaaaaatc tcccctttac tttcgcgcgc gattggtata      480

ctctgagtcg ttgcgttgga attcgtgact cttttttcgtt cctgtagcgc caagaccttg      540
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atcaaggtgg tttaaaaaaa ccgatttgac aaggtcattc agtgctatct ggagtcgttc   600

aggggatcg ggttcctcag cagaccaatt gctcaaaaat accagcggtg ttgatctgca   660

cttaatggcc ttgaccagcc aggtgcaatt acccgcgtga g gtg ctg gaa gga ctc   716
                                              Val Leu Glu Gly Leu
                                              1   5

atc ttg gca gtc tcc cgc cag acc aag tca gtc gtc gat att ccc ggt   764
Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val Val Asp Ile Pro Gly
            10   15   20

gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg   812
Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val
            25   30   35

ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt   860
Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly
            40   45   50

acg cct gag tgg cgt gct cgt cag aag gaa gaa ttc ggc gag gga gcc   908
Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu Phe Gly Glu Gly Ala
            55   60   65

cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc   956
Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Glu Leu Ser Pro Ile
70   75   80   85

cag gat tac tct gga aac atg tcc ctg agc ctt tcg gag cca cgc ttc   1004
Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu Ser Glu Pro Arg Phe
            90   95   100

gaa gac gtc aag aac acc att gac gag gcg aaa gaa aag gac atc aac   1052
Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys Glu Lys Asp Ile Asn
            105   110   115

tac gcg gcg cca ctg tat gtg acc gcg gag ttc gtc aac aac acc acc   1100
Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe Val Asn Asn Thr Thr
            120   125   130

ggt gaa atc aag tct cag act gtc ttc atc ggc gat ttc cca atg atg   1148
Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly Asp Phe Pro Met Met
            135   140   145

acg gac aag gga acg ttc atc atc aac gga acc gaa cgc gtt gtg gtc   1196
Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr Glu Arg Val Val Val
150   155   160   165

agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat   1244
Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp
            170   175   180

aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct ttc cgt   1292
Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Phe Arg
            185   190   195

ggt gct tgg ctt gag ttt gac gtc gat aag cgc gat tcg gtt ggt gtt   1340

14

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          Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg Asp Ser Val Gly Val
                   200                 205                 210

          cgt att gac cgc aag cgt cgc cag cca gtc acc gta ctg ctg aag gct      1388
          Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr Val Leu Leu Lys Ala
                   215                 220                 225

          ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa      1436
          Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Gly Phe Ser Glu
          230                 235                 240                 245

          atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag      1484
          Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu
                             250                 255                 260

          gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc      1532
          Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Glu Gln Pro Thr
                             265                 270                 275

          cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag      1580
          Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys
                   280                 285                 290

          cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc      1628
          Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu
                   295                 300                 305

          ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac      1676
          Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp
          310                 315                 320                 325

          atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc      1724
          Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg
                             330                 335                 340

          gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac      1772
          Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro Val Glu Thr Asp Asp
                             345                 350                 355

          atc gac cac ttt ggt aac cgt cgt ctg cgt acc gtt ggc gaa ctg atc      1820
          Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile
                             360                 365                 370

          cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt      1868
          Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg
                   375                 380                 385

          gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg      1916
          Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu
          390                 395                 400                 405

          atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act      1964
          Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr
                             410                 415                 420

          tcc cag ctg tct cag ttc atg gtc cag aac aac tcc ctg tct ggt ttg      2012
          Ser Gln Leu Ser Gln Phe Met Val Gln Asn Asn Ser Leu Ser Gly Leu
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15

act cac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt   2060
Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg
        440   445   450

gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc   2108
Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly
        455   460   465

cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc   2156
Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile
470   475   480   485

ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag   2204
Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu
                490   495   500

acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac   2252
Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp
                505   510   515

tac ctt acc gct gat gag gaa gac cgc ttc gtt gtt gcg cag gca aac   2300
Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn
        520   525   530

acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt   2348
Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp Glu Thr Val Thr Val
        535   540   545

cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gcg gtt gat   2396
Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp
550   555   560   565

tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gcg atg   2444
Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met
                570   575   580

att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gcg   2492
Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala
                585   590   595

aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc   2540
Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe
                600   605   610

gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg   2588
Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu
        615   620   625

gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc   2636
Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe
630   635   640   645

atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt   2684
Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg
                650   655   660

16

```
aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg        2732
Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr Asn Gln Lys Pro Leu
            665                 670                 675

gtt aac ttg ggc gag cgc gtt gaa gct ggc cag gtt att gct gat ggt        2780
Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly
            680                 685                 690

cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt        2828
Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val
            695                 700                 705

gcg ttc atg cct tgg gaa ggc cac aac tac gag gat gcg atc atc ctc        2876
Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu
710             715                 720                 725

aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag        2924
Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu
            730                 735                 740

gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc        2972
Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile
            745                 750                 755

acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac        3020
Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp
            760                 765                 770

gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc        3068
Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile
            775                 780                 785

ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa        3116
Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu
790             795                 800                 805

gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc        3164
Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg
                810                 815                 820

gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc        3212
Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly
            825                 830                 835

gtg cgt cac ttc tcc cgc gag gac gac gac gat ctg gct cct ggc gtc        3260
Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val
            840                 845                 850

aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac        3308
Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp
            855                 860                 865

ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa        3356
Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys
870             875                 880                 885
```

17

```
att ttg cct cag ·gaa gat atg cca ttc ctt cca gac ggc act cct gtt    3404
Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val
                890                 895                 900

gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt    3452
Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly
                905                 910                 915

cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc    3500
Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser
                920                 925                 930

gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct    3548
Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro
    935                 940                 945

gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg    3596
Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val
950                 955                 960                 965

ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca    3644
Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser
                970                 975                 980

cgt cca aac cgc gac ggc gac gtc atg gtt aac gcg gat ggt aaa gca    3692
Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala
                985                 990                 995

acg ctt atc  gac ggt cgc tcc ggt  gag cct tac ccg tac  ccg gtt    3737
Thr Leu Ile  Asp Gly Arg Ser Gly  Glu Pro Tyr Pro Tyr  Pro Val
             1000            1005                1010

tcc atc ggc  tac atg tac atg ctg  aag ctg cac cac ctc  gtt gac    3782
Ser Ile Gly  Tyr Met Tyr Met Leu  Lys Leu His His Leu  Val Asp
             1015            1020                1025

gag aag atc  cac gca cgt tcc act  ggt cct tac tcc atg  att acc    3827
Glu Lys Ile  His Ala Arg Ser Thr  Gly Pro Tyr Ser Met  Ile Thr
             1030            1035                1040

cag cag cca  ctg ggt ggt aaa gca  cag ttc ggt gga cag  cgt ttc    3872
Gln Gln Pro  Leu Gly Gly Lys Ala  Gln Phe Gly Gly Gln  Arg Phe
             1045            1050                1055

ggc gaa atg  gag gtg tgg gca atg  cag gca tac ggc gct  gcc tac    3917
Gly Glu Met  Glu Val Trp Ala Met  Gln Ala Tyr Gly Ala  Ala Tyr
             1060            1065                1070

aca ctt cag  gag ctg ctg acc atc  aag tct gat gac gtg  gtt ggc    3962
Thr Leu Gln  Glu Leu Leu Thr Ile  Lys Ser Asp Asp Val  Val Gly
             1075            1080                1085

cgt gtc aag  gtc tac gaa gca att  gtg aag ggc gag aac  atc ccg    4007
Arg Val Lys  Val Tyr Glu Ala Ile  Val Lys Gly Glu Asn  Ile Pro
             1090            1095                1100

gat cca ggt  att cct gag tcc ttc  aag gtt ctc ctc aag  gag ctc    4052
```

18

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Asp Pro Gly   Ile Pro Glu Ser Phe   Lys Val Leu Leu Lys   Glu Leu
        1105              1110                  1115

cag tcc ttg   tgc ctg aac gtg gag   gtt ctc tcc gca gac   ggc act        4097
Gln Ser Leu   Cys Leu Asn Val Glu   Val Leu Ser Ala Asp   Gly Thr
        1120              1125                  1130

cca atg gag   ctc gcg ggt gac gac   gac gac ttc gat cag   gca ggc        4142
Pro Met Glu   Leu Ala Gly Asp Asp   Asp Asp Phe Asp Gln   Ala Gly
        1135              1140                  1145

gcc tca ctt   ggc atc aac ctg tcc   cgt gac gag cgt tcc   gac gcc        4187
Ala Ser Leu   Gly Ile Asn Leu Ser   Arg Asp Glu Arg Ser   Asp Ala
        1150              1155                  1160

gac acc gca   tagcagatca gaaaacaacc gctagaaatc aagccataca               4236
Asp Thr Ala
        1165

tcccccggac attgaagaga tgttctgggg ggaaagggag ttttacgtgc tcgacgtaaa        4296

cgtcttcgat gagctccgca tcggcctggc caccgccgac gacatccgcc gttggtccaa        4356

gggtgaggtc aagaagccgg agaccatcaa ctaccgaacc ctcaagcctg agaaggacgg        4416

tctgttctgc gagcgtatct tcggtccaac tcgcgactgg gagtgcgcct gcggtaagta        4476

caagcgtgtc cgctacaagg gcatcatctg tgaacgctgt ggcgttgagg tcaccaagtc        4536

caaggtgcgc cgtgagcgca tgggacacat tgagctcgct gcaccagtaa cccacatttg        4596

gtacttcaag ggcgttccat cacgcctcgg ctaccttttg gaccttgctc caaaggacct        4656

ggacctcatc atctacttcg gtgcgaacat catcaccagc gtggacgaag aggctcgcca        4716

cagcgaccag accactcttg aggcagaaat gcttctggag aagaaggacg ttgaggcaga        4776

cgcagagtct gacattgctg agcgtgctga aaagctcgaa gaggatcttg ctgaacttga        4836

ggcagctggc gctaaggccg acgctcgccg caaggttcag gctgctgccg ataaggaaat        4896

gcagcacatc cgtgagcgtg cacagcgcga aatcgatcgt ctcgatgagg tctggcagac        4956

cttcatcaag cttgctccaa agcagatgat ccgcgatgag aagctctacg atgaactgat        5016

cgaccgctac gaggattact tcaccggtgg tatgggtgca gagtccattg aggctttgat        5076

ccagaacttc gaccttgatg ctg                                               5099


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<212>  PRT
<213>  Corynebacterium glutamicum

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19

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Val Leu Glu Gly Leu Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val
1             5                   10                  15

Val Asp Ile Pro Gly Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser
            20                  25                  30

Ala Pro Ile Glu Val Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr
        35                  40                  45

Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu
    50                  55                  60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu
65                  70                  75                  80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu
            85                  90                  95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys
            100                 105                 110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe
        115                 120                 125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly
    130                 135                 140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr
145                 150                 155                 160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe
            165                 170                 175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys
        180                 185                 190

Val Ile Pro Phe Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg
        195                 200                 205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Gln Pro Val Thr
    210                 215                 220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg
```

20

Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val
            245   250   255

Ala Asn Thr Asp Glu Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro
            260   265   270

Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser
            275   280   285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys
    290   295   300

Ile Asn Arg Lys Leu Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr
305   310   315   320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu
            325   330   335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro
            340   345   350

Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr
            355   360   365

Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met
    370   375   380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile
385   390   395   400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg
            405   410   415

Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Val Gln Asn Asn
            420   425   430

Ser Leu Ser Gly Leu Thr His Lys Arg Arg Leu Ser Ala Leu Gly Pro
            435   440   445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His
    450   455   460

21

```
Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro
465             470             475             480

Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro
                485             490             495

Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu
            500             505             510

Thr Asp Gln Ile Asp Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val
            515             520             525

Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp
        530             535             540

Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly
545             550             555             560

Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser
            565             570             575

Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg
            580             585             590

Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg
        595             600             605

Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr
    610             615             620

Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn
625             630             635             640

Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu
            645             650             655

Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr
        660             665             670

Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln
        675             680             685
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22

```
Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly
    690             695             700

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu
705             710             715                 720

Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr
            725             730                 735

Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu
        740             745                 750

Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val
        755             760                 765

Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val
    770             775                 780

Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr
785             790                 795                 800

Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys
            805             810                 815

Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr
            820             825                 830

Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp
        835             840             845

Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys
    850             855             860

Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys
865             870             875                 880

Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro
            885             890                 895

Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg
            900             905             910
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Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala
        915                 920             925

Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu
    930                 935             940

Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu
945             950             955                 960

Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly
                965             970                 975

Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn
            980             985             990

Ala Asp Gly Lys Ala Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr
        995                 1000            1005

Pro Tyr Pro Val Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His
    1010            1015            1020

His Leu Val Asp Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr
    1025            1030            1035

Ser Met Ile Thr Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly
    1040            1045            1050

Gly Gln Arg Phe Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr
    1055            1060            1065

Gly Ala Ala Tyr Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp
    1070            1075            1080

Asp Val Val Gly Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly
    1085            1090            1095

Glu Asn Ile Pro Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu
    1100            1105            1110

Leu Lys Glu Leu Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser
    1115            1120            1125

Ala Asp Gly Thr Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe
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24

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        1130                1135                    1140


      Asp Gln  Ala Gly Ala Ser Leu  Gly Ile Asn Leu Ser  Arg Asp Glu
         1145                1150                1155


      Arg Ser  Asp Ala Asp Thr Ala
         1160                1165


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      <223>


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      <221>  mutation
      <222>  (2016)..(2016)
      <223>  Substitution of cytosine by thymine


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      aaaatattga tgattttac ggcgaccgca gcggccagaa gtacgaacag aaattgcttt          120

      tcgacgcctc cctcgacgat gcagctgtct ctaagctggt tgcacaggcc gaaagcatcc          180

      ctgatggaga tgtgagcaaa atcgcaaata ccgtaggtat tgtgatcggt gcggtattgg          240

      ctctcgtggg cctggccggg tgttttgggg cgtttgggaa gaaacgtcga gaagcttaac          300

      ctgctgttca aatagatttt ccctgtttcg aattgcggaa accccgggtt tgtttgctag          360

      ggtgcctcgt agaaggggtc aagaagattt ctgggaaacg cgcccgtgcg gttggttgct          420

      aatagcacgc ggagcaccag atgaaaaatc tccccttttac tttcgcgcgc gattggtata          480

      ctctgagtcg ttgcgttgga attcgtgact cttttttcgtt cctgtagcgc caagaccttg          540

      atcaaggtgg tttaaaaaaa ccgatttgac aaggtcattc agtgctatct ggagtcgttc          600

      aggggggatcg ggttcctcag cagaccaatt gctcaaaaat accagcggtg ttgatctgca          660

      cttaatggcc ttgaccagcc aggtgcaatt acccgcgtga g gtg ctg gaa gga ccc          716
                                                  Val Leu Glu Gly Pro
                                                    1                 5


      atc ttg gca gtc tcc cgc cag acc aag tca gtc gtc gat att ccc ggt          764
      Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val Val Asp Ile Pro Gly
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gca ccg cag cgt tat tct ttc gcg aag gtg tcc gca ccc att gag gtg      812
Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser Ala Pro Ile Glu Val
        25                  30                  35

ccc ggg cta cta gat ctt caa ctg gat tct tac tcc tgg ctg att ggt      860
Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr Ser Trp Leu Ile Gly
        40                  45                  50

acg cct gag tgg cgt gct cgt cag aag gaa gaa ttc ggc gag gga gcc      908
Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu Phe Gly Glu Gly Ala
        55                  60                  65

cgc gta acc agc ggc ctt gag aac att ctc gag gag ctc tcc cca atc      956
Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu Glu Leu Ser Pro Ile
70                  75                  80                  85

cag gat tac tct gga aac atg tcc ctg agc ctt tcg gag cca cgc ttc     1004
Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu Ser Glu Pro Arg Phe
                    90                  95                  100

gaa gac gtc aag aac acc att gac gag gcg aaa gaa aag gac atc aac     1052
Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys Glu Lys Asp Ile Asn
                105                 110                 115

tac gcg gcg cca ctg tat gtg acc gcg gag ttc gtc aac aac acc acc     1100
Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe Val Asn Asn Thr Thr
            120                 125                 130

ggt gaa atc aag tct cag act gtc ttc atc ggc gat ttc cca atg atg     1148
Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly Asp Phe Pro Met Met
        135                 140                 145

acg gac aag gga acg ttc atc atc aac gga acc gaa cgc gtt gtg gtc     1196
Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr Glu Arg Val Val Val
150                 155                 160                 165

agc cag ctc gtc cgc tcc ccg ggc gtg tac ttt gac cag acc atc gat     1244
Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe Asp Gln Thr Ile Asp
                170                 175                 180

aag tca act gag cgt cca ctg cac gcc gtg aag gtt att cct tcc cgt     1292
Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys Val Ile Pro Ser Arg
                185                 190                 195

ggt gct tgg ctt gag ttt gac gtc gat aag cgc gat tcg gtt ggt gtt     1340
Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg Asp Ser Val Gly Val
        200                 205                 210

cgt att gac cgc aag cgt cgc cag cca gtc acc gta ctg ctg aag gct     1388
Arg Ile Asp Arg Lys Arg Arg Gln Pro Val Thr Val Leu Leu Lys Ala
        215                 220                 225

ctt ggc tgg acc act gag cag atc acc gag cgt ttc ggt ttc tct gaa     1436
Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg Phe Gly Phe Ser Glu
230                 235                 240                 245
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26

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atc atg atg tcc acc ctc gag tcc gat ggt gta gca aac acc gat gag       1484
Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val Ala Asn Thr Asp Glu
                250             255                 260

gca ttg ctg gag atc tac cgc aag cag cgt cca ggc gag cag cct acc       1532
Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro Gly Glu Gln Pro Thr
                265             270                 275

cgc gac ctt gcg cag tcc ctc ctg gac aac agc ttc ttc cgt gca aag       1580
Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser Phe Phe Arg Ala Lys
            280             285                 290

cgc tac gac ctg gct cgc gtt ggt cgt tac aag atc aac cgc aag ctc       1628
Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys Ile Asn Arg Lys Leu
        295             300                 305

ggc ctt ggt ggc gac cac gat ggt ttg atg act ctt act gaa gag gac       1676
Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr Leu Thr Glu Glu Asp
310             315                 320                 325

atc gca acc acc atc gag tac ctg gtg cgt ctg cac gca ggt gag cgc       1724
Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu His Ala Gly Glu Arg
                330             335                 340

gtc atg act tct cca aat ggt gaa gag atc cca gtc gag acc gat gac       1772
Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro Val Glu Thr Asp Asp
                345             350                 355

atc gac cac ttt ggt aac cgt cgt ctg cgt acc gtt ggc gaa ctg atc       1820
Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr Val Gly Glu Leu Ile
            360             365                 370

cag aac cag gtc cgt gtc ggc ctg tcc cgc atg gag cgc gtt gtt cgt       1868
Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met Glu Arg Val Val Arg
375             380                 385

gag cgt atg acc acc cag gat gcg gag tcc att act cct act tcc ttg       1916
Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile Thr Pro Thr Ser Leu
390             395                 400                 405

atc aac gtt cgt cct gtc tct gca gct atc cgt gag ttc ttc gga act       1964
Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg Glu Phe Phe Gly Thr
                410             415                 420

tcc cag ctg tct cag ttc atg gac cag aac aac tcc ctg tct ggt ttg       2012
Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn Ser Leu Ser Gly Leu
            425             430                 435

act tac aag cgt cgt ctg tcg gct ctg ggc ccg ggt ggt ctg tcc cgt       2060
Thr Tyr Lys Arg Arg Leu Ser Ala Leu Gly Pro Gly Gly Leu Ser Arg
        440             445                 450

gag cgc gcc ggc atc gag gtt cga gac gtt cac cca tct cac tac ggc       2108
Glu Arg Ala Gly Ile Glu Val Arg Asp Val His Pro Ser His Tyr Gly
        455             460                 465
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27

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cgt atg tgc cca att gag act ccg gaa ggt cca aac att ggc ctg atc        2156
Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro Asn Ile Gly Leu Ile
470             475             480             485

ggt tcc ttg gct tcc tat gct cga gtg aac cca ttc ggt ttc att gag        2204
Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro Phe Gly Phe Ile Glu
            490             495             500

acc cca tac cgt cgc atc atc gac ggc aag ctg acc gac cag att gac        2252
Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu Thr Asp Gln Ile Asp
        505             510             515

tac ctt acc gct gat gag gaa gac cgc ttc gtt gtt gcg cag gca aac        2300
Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val Val Ala Gln Ala Asn
        520             525             530

acg cac tac gac gaa gag ggc aac atc acc gat gag acc gtc act gtt        2348
Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp Glu Thr Val Thr Val
        535             540             545

cgt ctg aag gac ggc gac atc gcc atg gtt ggc cgc aac gcg gtt gat        2396
Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly Arg Asn Ala Val Asp
550             555             560             565

tac atg gac gtt tcc cct cgt cag atg gtt tct gtt ggt acc gcg atg        2444
Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser Val Gly Thr Ala Met
            570             575             580

att cca ttc ctg gag cac gac gat gct aac cgt gca ctg atg ggc gcg        2492
Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg Ala Leu Met Gly Ala
            585             590             595

aac atg cag aag cag gct gtg cca ctg att cgt gcc gag gct cct ttc        2540
Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg Ala Glu Ala Pro Phe
        600             605             610

gtg ggc acc ggt atg gag cag cgc gca gca tac gac gcc ggc gac ctg        2588
Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr Asp Ala Gly Asp Leu
        615             620             625

gtt att acc cca gtc gca ggt gtg gtg gaa aac gtt tca gct gac ttc        2636
Val Ile Thr Pro Val Ala Gly Val Val Glu Asn Val Ser Ala Asp Phe
630             635             640             645

atc acc atc atg gct gat gac ggc aag cgc gaa acc tac ctg ctg cgt        2684
Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu Thr Tyr Leu Leu Arg
                650             655             660

aag ttc cag cgc acc aac cag ggc acc agc tac aac cag aag cct ttg        2732
Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr Asn Gln Lys Pro Leu
            665             670             675

gtt aac ttg ggc gag cgc gtt gaa gct ggc cag gtt att gct gat ggt        2780
Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln Val Ile Ala Asp Gly
            680             685             690

cca ggt acc ttc aat ggt gaa atg tcc ctt ggc cgt aac ctt ctg gtt        2828
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28

```
Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly Arg Asn Leu Leu Val
    695                 700             705

gcg ttc atg cct tgg gaa ggc cac aac tac gag gat gcg atc atc ctc    2876
Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu Asp Ala Ile Ile Leu
710             715             720             725

aac cag aac atc gtt gag cag gac atc ttg acc tcg atc cac atc gag    2924
Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr Ser Ile His Ile Glu
                730             735             740

gag cac gag atc gat gcc cgc gac act aag ctt ggc gcc gaa gaa atc    2972
Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu Gly Ala Glu Glu Ile
                745             750             755

acc cgc gac atc cct aat gtg tct gaa gaa gtc ctc aag gac ctc gac    3020
Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val Leu Lys Asp Leu Asp
            760             765             770

gac cgc ggt att gtc cgc atc ggt gct gat gtt cgt gac ggc gac atc    3068
Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val Arg Asp Gly Asp Ile
        775             780             785

ctg gtc ggt aag gtc acc cct aag ggc gag acc gag ctc acc ccg gaa    3116
Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr Glu Leu Thr Pro Glu
790             795             800             805

gag cgc ttg ctg cgc gca atc ttc ggt gag aag gcc cgc gaa gtt cgc    3164
Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys Ala Arg Glu Val Arg
                810             815             820

gat acc tcc atg aag gtg cct cac ggt gag acc ggc aag gtc atc ggc    3212
Asp Thr Ser Met Lys Val Pro His Gly Glu Thr Gly Lys Val Ile Gly
            825             830             835

gtg cgt cac ttc tcc cgc gag gac gac gac gat ctg gct cct ggc gtc    3260
Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp Leu Ala Pro Gly Val
        840             845             850

aac gag atg atc cgt atc tac gtt gct cag aag cgt aag atc cag gac    3308
Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys Arg Lys Ile Gln Asp
        855             860             865

ggc gat aag ctc gct ggc cgc cac ggt aac aag ggt gtt gtc ggt aaa    3356
Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys Gly Val Val Gly Lys
870             875             880             885

att ttg cct cag gaa gat atg cca ttc ctt cca gac ggc act cct gtt    3404
Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro Asp Gly Thr Pro Val
                890             895             900

gac atc atc ttg aac acc cac ggt gtt cca cgt cgt atg aac att ggt    3452
Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg Arg Met Asn Ile Gly
            905             910             915

cag gtt ctt gag acc cac ctt ggc tgg ctg gca tct gct ggt tgg tcc    3500
Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala Ser Ala Gly Trp Ser
```

```
gtg gat cct gaa gat cct gag aac gct gag ctc gtc aag act ctg cct    3548
Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu Val Lys Thr Leu Pro
        935                 940                 945

gca gac ctc ctc gag gtt cct gct ggt tcc ttg act gca act cct gtg    3596
Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu Thr Ala Thr Pro Val
950                 955                 960                 965

ttc gac ggt gcg tca aac gaa gag ctc gca ggc ctg ctc gct aat tca    3644
Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly Leu Leu Ala Asn Ser
                970                 975                 980

cgt cca aac cgc gac ggc gac gtc atg gtt aac gcg gat ggt aaa gca    3692
Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn Ala Asp Gly Lys Ala
                985                 990                 995

acg ctt atc gac ggt cgc tcc ggt gag cct tac ccg tac ccg gtt        3737
Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr Pro Tyr Pro Val
            1000                1005                1010

tcc atc ggc tac atg tac atg ctg aag ctg cac cac ctc gtt gac        3782
Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His His Leu Val Asp
            1015                1020                1025

gag aag atc cac gca cgt tcc act ggt cct tac tcc atg att acc        3827
Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr Ser Met Ile Thr
            1030                1035                1040

cag cag cca ctg ggt ggt aaa gca cag ttc ggt gga cag cgt ttc        3872
Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly Gly Gln Arg Phe
            1045                1050                1055

ggc gaa atg gag gtg tgg gca atg cag gca tac ggc gct gcc tac        3917
Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr Gly Ala Ala Tyr
            1060                1065                1070

aca ctt cag gag ctg ctg acc atc aag tct gat gac gtg gtt ggc        3962
Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp Asp Val Val Gly
            1075                1080                1085

cgt gtc aag gtc tac gaa gca att gtg aag ggc gag aac atc ccg        4007
Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly Glu Asn Ile Pro
            1090                1095                1100

gat cca ggt att cct gag tcc ttc aag gtt ctc ctc aag gag ctc        4052
Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu Leu Lys Glu Leu
            1105                1110                1115

cag tcc ttg tgc ctg aac gtg gag gtt ctc tcc gca gac ggc act        4097
Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser Ala Asp Gly Thr
            1120                1125                1130

cca atg gag ctc gcg ggt gac gac gac gac ttc gat cag gca ggc        4142
Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe Asp Gln Ala Gly
            1135                1140                1145
```

30

```
gcc tca ctt  ggc atc aac ctg tcc  cgt gac gag cgt tcc  gac gcc        4187
Ala Ser Leu  Gly Ile Asn Leu Ser  Arg Asp Glu Arg Ser  Asp Ala
        1150              1155              1160

gac acc gca  tagcagatca gaaaacaacc gctagaaatc aagccataca             4236
Asp Thr Ala
        1165

tcccccggac attgaagaga tgttctgggg ggaaagggag ttttacgtgc tcgacgtaaa   4296

cgtcttcgat gagctccgca tcggcctggc caccgccgac gacatccgcc gttggtccaa   4356

gggtgaggtc aagaagccgg agaccatcaa ctaccgaacc ctcaagcctg agaaggacgg   4416

tctgttctgc gagcgtatct tcggtccaac tcgcgactgg gagtgcgcct gcggtaagta   4476

caagcgtgtc cgctacaagg gcatcatctg tgaacgctgt ggcgttgagg tcaccaagtc   4536

caaggtgcgc cgtgagcgca tgggacacat tgagctcgct gcaccagtaa cccacatttg   4596

gtacttcaag ggcgttccat cacgcctcgg ctaccttttg gaccttgctc caaaggacct   4656

ggacctcatc atctacttcg gtgcgaacat catcaccagc gtggacgaag aggctcgcca   4716

cagcgaccag accactcttg aggcagaaat gcttctggag aagaaggacg ttgaggcaga   4776

cgcagagtct gacattgctg agcgtgctga aaagctcgaa gaggatcttg ctgaacttga   4836

ggcagctggc gctaaggccg acgctcgccg caaggttcag gctgctgccg ataaggaaat   4896

gcagcacatc cgtgagcgtg cacagcgcga aatcgatcgt ctcgatgagg tctggcagac   4956

cttcatcaag cttgctccaa agcagatgat ccgcgatgag aagctctacg atgaactgat   5016

cgaccgctac gaggattact tcaccggtgg tatgggtgca gagtccattg aggctttgat   5076

ccagaacttc gaccttgatg ctg                                           5099


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<213>  Corynebacterium glutamicum

<400>  6

Val Leu Glu Gly Pro Ile Leu Ala Val Ser Arg Gln Thr Lys Ser Val
1               5                  10                  15


Val Asp Ile Pro Gly Ala Pro Gln Arg Tyr Ser Phe Ala Lys Val Ser
            20                  25                  30


Ala Pro Ile Glu Val Pro Gly Leu Leu Asp Leu Gln Leu Asp Ser Tyr
        35                  40                  45
```

31

```
Ser Trp Leu Ile Gly Thr Pro Glu Trp Arg Ala Arg Gln Lys Glu Glu
    50              55          60

Phe Gly Glu Gly Ala Arg Val Thr Ser Gly Leu Glu Asn Ile Leu Glu
65              70          75                      80

Glu Leu Ser Pro Ile Gln Asp Tyr Ser Gly Asn Met Ser Leu Ser Leu
            85              90              95

Ser Glu Pro Arg Phe Glu Asp Val Lys Asn Thr Ile Asp Glu Ala Lys
            100             105             110

Glu Lys Asp Ile Asn Tyr Ala Ala Pro Leu Tyr Val Thr Ala Glu Phe
        115             120             125

Val Asn Asn Thr Thr Gly Glu Ile Lys Ser Gln Thr Val Phe Ile Gly
    130             135             140

Asp Phe Pro Met Met Thr Asp Lys Gly Thr Phe Ile Ile Asn Gly Thr
145             150             155             160

Glu Arg Val Val Val Ser Gln Leu Val Arg Ser Pro Gly Val Tyr Phe
            165             170             175

Asp Gln Thr Ile Asp Lys Ser Thr Glu Arg Pro Leu His Ala Val Lys
            180             185             190

Val Ile Pro Ser Arg Gly Ala Trp Leu Glu Phe Asp Val Asp Lys Arg
        195             200             205

Asp Ser Val Gly Val Arg Ile Asp Arg Lys Arg Gln Pro Val Thr
    210             215             220

Val Leu Leu Lys Ala Leu Gly Trp Thr Thr Glu Gln Ile Thr Glu Arg
225             230             235             240

Phe Gly Phe Ser Glu Ile Met Met Ser Thr Leu Glu Ser Asp Gly Val
            245             250             255

Ala Asn Thr Asp Glu Ala Leu Leu Glu Ile Tyr Arg Lys Gln Arg Pro
            260             265             270
```

32

```
Gly Glu Gln Pro Thr Arg Asp Leu Ala Gln Ser Leu Leu Asp Asn Ser
    275                 280             285

Phe Phe Arg Ala Lys Arg Tyr Asp Leu Ala Arg Val Gly Arg Tyr Lys
    290             295             300

Ile Asn Arg Lys Leu Gly Leu Gly Gly Asp His Asp Gly Leu Met Thr
305             310             315                 320

Leu Thr Glu Glu Asp Ile Ala Thr Thr Ile Glu Tyr Leu Val Arg Leu
            325             330             335

His Ala Gly Glu Arg Val Met Thr Ser Pro Asn Gly Glu Glu Ile Pro
            340             345             350

Val Glu Thr Asp Asp Ile Asp His Phe Gly Asn Arg Arg Leu Arg Thr
            355             360             365

Val Gly Glu Leu Ile Gln Asn Gln Val Arg Val Gly Leu Ser Arg Met
    370             375             380

Glu Arg Val Val Arg Glu Arg Met Thr Thr Gln Asp Ala Glu Ser Ile
385             390             395                 400

Thr Pro Thr Ser Leu Ile Asn Val Arg Pro Val Ser Ala Ala Ile Arg
            405             410             415

Glu Phe Phe Gly Thr Ser Gln Leu Ser Gln Phe Met Asp Gln Asn Asn
            420             425             430

Ser Leu Ser Gly Leu Thr Tyr Lys Arg Arg Leu Ser Ala Leu Gly Pro
    435             440             445

Gly Gly Leu Ser Arg Glu Arg Ala Gly Ile Glu Val Arg Asp Val His
    450             455             460

Pro Ser His Tyr Gly Arg Met Cys Pro Ile Glu Thr Pro Glu Gly Pro
465             470             475                 480

Asn Ile Gly Leu Ile Gly Ser Leu Ala Ser Tyr Ala Arg Val Asn Pro
            485             490             495
```

33

```
Phe Gly Phe Ile Glu Thr Pro Tyr Arg Arg Ile Ile Asp Gly Lys Leu
            500             505             510

Thr Asp Gln Ile Asp Tyr Leu Thr Ala Asp Glu Glu Asp Arg Phe Val
            515             520             525

Val Ala Gln Ala Asn Thr His Tyr Asp Glu Glu Gly Asn Ile Thr Asp
            530             535             540

Glu Thr Val Thr Val Arg Leu Lys Asp Gly Asp Ile Ala Met Val Gly
545             550             555             560

Arg Asn Ala Val Asp Tyr Met Asp Val Ser Pro Arg Gln Met Val Ser
                565             570             575

Val Gly Thr Ala Met Ile Pro Phe Leu Glu His Asp Asp Ala Asn Arg
            580             585             590

Ala Leu Met Gly Ala Asn Met Gln Lys Gln Ala Val Pro Leu Ile Arg
            595             600             605

Ala Glu Ala Pro Phe Val Gly Thr Gly Met Glu Gln Arg Ala Ala Tyr
    610             615             620

Asp Ala Gly Asp Leu Val Ile Thr Pro Val Ala Gly Val Val Glu Asn
625             630             635             640

Val Ser Ala Asp Phe Ile Thr Ile Met Ala Asp Asp Gly Lys Arg Glu
                645             650             655

Thr Tyr Leu Leu Arg Lys Phe Gln Arg Thr Asn Gln Gly Thr Ser Tyr
            660             665             670

Asn Gln Lys Pro Leu Val Asn Leu Gly Glu Arg Val Glu Ala Gly Gln
            675             680             685

Val Ile Ala Asp Gly Pro Gly Thr Phe Asn Gly Glu Met Ser Leu Gly
    690             695             700

Arg Asn Leu Leu Val Ala Phe Met Pro Trp Glu Gly His Asn Tyr Glu
705             710             715             720

Asp Ala Ile Ile Leu Asn Gln Asn Ile Val Glu Gln Asp Ile Leu Thr
```

34

```
                725                    730                         735

    Ser Ile His Ile Glu Glu His Glu Ile Asp Ala Arg Asp Thr Lys Leu
                740              745                750

    Gly Ala Glu Glu Ile Thr Arg Asp Ile Pro Asn Val Ser Glu Glu Val
                755              760                765

    Leu Lys Asp Leu Asp Asp Arg Gly Ile Val Arg Ile Gly Ala Asp Val
                770          775                780

    Arg Asp Gly Asp Ile Leu Val Gly Lys Val Thr Pro Lys Gly Glu Thr
    785              790                795                    800

    Glu Leu Thr Pro Glu Glu Arg Leu Leu Arg Ala Ile Phe Gly Glu Lys
                    805                810                815

    Ala Arg Glu Val Arg Asp Thr Ser Met Lys Val Pro His Gly Glu Thr
                820              825                830

    Gly Lys Val Ile Gly Val Arg His Phe Ser Arg Glu Asp Asp Asp Asp
                835              840                845

    Leu Ala Pro Gly Val Asn Glu Met Ile Arg Ile Tyr Val Ala Gln Lys
    850              855                860

    Arg Lys Ile Gln Asp Gly Asp Lys Leu Ala Gly Arg His Gly Asn Lys
    865              870                875                    880

    Gly Val Val Gly Lys Ile Leu Pro Gln Glu Asp Met Pro Phe Leu Pro
                    885                890                895

    Asp Gly Thr Pro Val Asp Ile Ile Leu Asn Thr His Gly Val Pro Arg
                900              905                910

    Arg Met Asn Ile Gly Gln Val Leu Glu Thr His Leu Gly Trp Leu Ala
                915              920                925

    Ser Ala Gly Trp Ser Val Asp Pro Glu Asp Pro Glu Asn Ala Glu Leu
                930          935                940

    Val Lys Thr Leu Pro Ala Asp Leu Leu Glu Val Pro Ala Gly Ser Leu
    945              950                955                    960

                                     35
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Thr Ala Thr Pro Val Phe Asp Gly Ala Ser Asn Glu Glu Leu Ala Gly
              965   970   975

Leu Leu Ala Asn Ser Arg Pro Asn Arg Asp Gly Asp Val Met Val Asn
              980   985   990

Ala Asp Gly Lys Ala Thr Leu Ile Asp Gly Arg Ser Gly Glu Pro Tyr
              995   1000   1005

Pro Tyr Pro Val Ser Ile Gly Tyr Met Tyr Met Leu Lys Leu His
        1010   1015   1020

His Leu Val Asp Glu Lys Ile His Ala Arg Ser Thr Gly Pro Tyr
        1025   1030   1035

Ser Met Ile Thr Gln Gln Pro Leu Gly Gly Lys Ala Gln Phe Gly
        1040   1045   1050

Gly Gln Arg Phe Gly Glu Met Glu Val Trp Ala Met Gln Ala Tyr
        1055   1060   1065

Gly Ala Ala Tyr Thr Leu Gln Glu Leu Leu Thr Ile Lys Ser Asp
        1070   1075   1080

Asp Val Val Gly Arg Val Lys Val Tyr Glu Ala Ile Val Lys Gly
        1085   1090   1095

Glu Asn Ile Pro Asp Pro Gly Ile Pro Glu Ser Phe Lys Val Leu
        1100   1105   1110

Leu Lys Glu Leu Gln Ser Leu Cys Leu Asn Val Glu Val Leu Ser
        1115   1120   1125

Ala Asp Gly Thr Pro Met Glu Leu Ala Gly Asp Asp Asp Asp Phe
        1130   1135   1140

Asp Gln Ala Gly Ala Ser Leu Gly Ile Asn Leu Ser Arg Asp Glu
        1145   1150   1155

Arg Ser Asp Ala Asp Thr Ala
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36

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<211> 1775
<212> DNA
<213> Corynebacterium glutamicum

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tcggttaagg tcagtggcga gcttctttgc tggttcgttt ccttgaggaa cagtcatggg   180

aaccattcta caagggatt tggtgttttc tgcggctagc tgataatgtg aacggctgag   240

tcccactctt gtagttggga attgacggca cctcgcactc aagcgcggta tcgcccctgg   300

ttttccggga cgcggtggcg catgtttgca tttgatgagg ttgtccgtga catgtttggt   360

cgggccccaa aaagagcccc ctttttttgcg tgtctggaca cttttcaaa tccttcgcca   420

tcgacaagct cagccttcgt gttcgtcccc cgggcgtcac gtcagcagtt aaagaacaac   480

tccgaaataa ggatggttc atg cca act att cag cag ctg gtc cgt aag ggc   532
                          Met Pro Thr Ile Gln Gln Leu Val Arg Lys Gly
                           1   5   10

cgc cac gat aag tcc gcc aag gtg gct acc gcg gca ctg aag ggt tcc   580
Arg His Asp Lys Ser Ala Lys Val Ala Thr Ala Ala Leu Lys Gly Ser
                  15   20   25

cct cag cgt cgt ggc gta tgc acc cgt gtg tac acc acc acc cct aag   628
Pro Gln Arg Arg Gly Val Cys Thr Arg Val Tyr Thr Thr Thr Pro Lys
              30   35   40

aag cct aac tct gct ctt cgt aag gtc gct cgt gtg cgc ctt acc tcc   676
Lys Pro Asn Ser Ala Leu Arg Lys Val Ala Arg Val Arg Leu Thr Ser
              45   50   55

ggc atc gag gtt tcc gct tac atc cct ggt gag ggc cac aac ctg cag   724
Gly Ile Glu Val Ser Ala Tyr Ile Pro Gly Glu Gly His Asn Leu Gln
60   65   70   75

gag cac tcc atg gtg ctc gtt cgc ggt ggt cgt gtt aag gac ctc cca   772
Glu His Ser Met Val Leu Val Arg Gly Gly Arg Val Lys Asp Leu Pro
                  80   85   90

ggt gtc cgt tac aag atc gtc cgt ggc gca ctg gat acc cag ggt gtt   820
Gly Val Arg Tyr Lys Ile Val Arg Gly Ala Leu Asp Thr Gln Gly Val
                  95   100   105

37

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aag gac cgc aag cag gct cgt tcc ccg cta cgg cgc gaa gag ggg ata      868
Lys Asp Arg Lys Gln Ala Arg Ser Pro Leu Arg Arg Glu Glu Gly Ile
        110                 115                 120

att aaa aat gcg taaatcagca gctcctaagc gtccagtagt tcaggaccct          920
Ile Lys Asn Ala
        125

gtatacaagt ccgagctcgt tacccagctc gtaaacaaga tcctcatcgg tggcaagaag     980

tccaccgcag agcgcatcgt ctacggtgca ctcgagatct gccgtgagaa gaccggcacc    1040

gatccagtag gaaccctcga gaaggctctc ggcaacgtgc gtccagacct cgaagttcgt    1100

tcccgccgtg ttggtggcgc tacctaccag gtgccagtgg atgttcgccc agagcgcgca    1160

aacaccctcg cactgcgttg gttggtaacc ttcacccgtc agcgtcgtga gaacaccatg    1220

atcgagcgtc ttgcaaacga acttctggat gcagccaacg gccttggcgc ttccgtgaag    1280

cgtcgcgaag acacccacaa gatggcagag gccaaccgcg ccttcgctca ctaccgctgg    1340

tagtactgcc aagacatgaa agcccaatca cctttaagat caacgcctgc cggcgccctt    1400

cacatttgaa taagctggca gcctgcgttt cttcaaggcg actgggcttt tagtctcatt    1460

aatgcagttc accgctgtaa gatagctaaa tagaaacact gtttcggcag tgtgttacta    1520

aaaaatccat gtcacttgcc tcgagcgtgc tgcttgaatc gcaagttagt ggcaaaatgt    1580

aacaagagaa ttatccgtag gtgacaaact ttttaatact tgggtatctg tcatggatac    1640

cccggtaata aataagtgaa ttaccgtaac caacaagttg gggtaccact gtggcacaag    1700

aagtgcttaa ggatctaaac aaggtccgca acatcggcat catggcgcac atcgatgctg    1760

gtaagaccac gacca                                                     1775
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<213> Corynebacterium glutamicum

<400> 8

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1               5                   10                  15


Ala Lys Val Ala Thr Ala Ala Leu Lys Gly Ser Pro Gln Arg Arg Gly
            20                  25                  30


Val Cys Thr Arg Val Tyr Thr Thr Thr Pro Lys Lys Pro Asn Ser Ala
            35                  40                  45
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38

Leu Arg Lys Val Ala Arg Val Arg Leu Thr Ser Gly Ile Glu Val Ser
        50   55   60

Ala Tyr Ile Pro Gly Glu Gly His Asn Leu Gln Glu His Ser Met Val
65   70   75   80

Leu Val Arg Gly Gly Arg Val Lys Asp Leu Pro Gly Val Arg Tyr Lys
                85   90   95

Ile Val Arg Gly Ala Leu Asp Thr Gln Gly Val Lys Asp Arg Lys Gln
                100   105   110

Ala Arg Ser Pro Leu Arg Arg Glu Glu Gly Ile Ile Lys Asn Ala
            115   120   125

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<210> 11
<211> 20
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<400> 11
aacacgcact acgacgaaga   20

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cagcatcaag gtcgaagttc                                                    20
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